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DEPARTMENT OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

C A M B R I D G E M A S S H U S E T T S 0 2 1 3 9

July 8, 1996

Honorable Reed E. Hundt, Chairman
Federal Communications Commission
1919 M Street N.W.
Washington, DC 20554

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Dear Chairman Hundt,

This letter relates to FCC 96-207 MM Docket No. 87-268 in the matter of **Advanced Television Systems and Their Impact Upon the Existing Television Broadcast Service**. My name is Jae Lim and I am a professor in the Department of Electrical Engineering and Computer Science at the Massachusetts Institute of Technology. I am also the director of MIT's Advanced Television Research Program and I have represented MIT in its participation in the Grand Alliance. The opinions expressed in this letter are, however, my personal opinions only.

The ATSC DTV Standard is the result of many years of hard work by a number of organizations and individuals. It is based on well-established engineering principles and is an excellent choice for the United States terrestrial broadcast standard. I urge the FCC to adopt the ATSC DTV Standard without delay with such further improvements as those recommended in this letter.

One significant improvement is the elimination of interlaced scanning and non-square-pixel formats in the SDTV. The importance of all-progressive and square-pixel formats has been studied and documented extensively. It suffices to note that the the ACATS' PS/WP4, which is the ACATS' working party on Alternative Media Technology and Broadcast Interface, concluded that Transmission of the signal in progressive format is the third most important characteristic that contributes significantly to interoperability, scope of services and features, and extensibility. The first two most important characteristics cited are an all-digital implementation based on a layered architecture model, and universal headers and descriptors. Transmission of the signal in progressive format was cited to be more important than the use of a flexible packet data transport structure, the fourth important characteristic. The working party was attended by a number of representatives of the broadcast, television, cable television, program production, motion picture, computer, telecommunications, and imaging industries. The relevant pages of the ATV System Recommendation (important points underlined), which reports the conclusions of the working party, are attached to this letter.

The video transmission formats consist of HDTV and SDTV formats. The HDTV formats were

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derived from the Grand Alliance HDTV system. The SDTV formats are the result of deliberation by the ATSC. The SDTV formats in the ATSC DTV Standard are as follows:

Vertical Lines	Horizontal Pixels	Aspect Ratio	Picture Rates	All Pro-Scan	All Square Pixels
480	704	16:9 & 4:3	60I 60P 30P 24P	No	No
480	640	4:3	60I 60P 30P 24P	No	Yes

The improved formats proposed are as follows:

Vertical Lines	Horizontal Pixels	Aspect Ratio	Picture Rates	All Pro-Scan	All Square Pixels
480	848	16:9*	60P 30P 24P	Yes	Yes
480	640	4:3	60P 30P 24P	Yes	Yes

These improved SDTV formats are not new and have been considered previously. They serve essentially most of the needs that the ATSC SDTV formats serve without serious consequences that result from the inclusion of interlaced scanning.

I strongly recommend that the FCC adopt the video formats proposed in this letter. Since extensive discussions took place on the format issue, the FCC can and should make a decision on this issue now without any delay in the process.

In summary, the ATSC DTV Standard with such further improvements as those suggested in this letter is an excellent choice for the U.S. terrestrial broadcast standard. I urge the FCC to decide on the U.S. terrestrial broadcast standard now.

Thank you for your attention to this matter.

Sincerely,



Professor Jae S. Lim
Director of Advanced Television/Telecommunications
Research Program
Massachusetts Institute of Technology

Enclosure

*The aspect ratio is very close to 16:9. This slight deviation has little practical significance.

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

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ATV SYSTEM RECOMMENDATION

**Federal Communications Commission
Advisory Committee on Advanced Television Service**

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1. EXECUTIVE SUMMARY

This document represents the work conducted to date under the auspices of the Advisory Committee on Advanced Television Service, which was formed in 1967 to advise the Federal Communications Commission on various aspects of advanced television. Through the efforts of hundreds of Advisory Committee participants, particularly those groups which have proposed systems for the Committee's consideration, extraordinary achievements in advanced television have been realized in a very short period. As a result of the Advisory Committee process, under the Commission's leadership, it has become apparent that digital high definition television service is achievable for the United States.

Testing and data analysis recently were completed on five high definition television systems. Previously, in its Fifth Interim Report to the FCC, the Advisory Committee approved a set of ten "Selection Criteria" for use in analyzing the performance of the systems tested. The criteria are grouped into three general categories: spectrum utilization, economics, and technology. In the same report, the Advisory Committee created a Special Panel that would use these criteria to evaluate the performance of tested ATV systems.

The Special Panel met on February 8 - 11, 1993, to consider these matters and to pass a report to the Parent Committee for its consideration. The resulting findings, the bases of which are set forth in Chapter 14 of this document, are as follows:

SPECTRUM UTILIZATION

1. The analysis conducted by the Advisory Committee clearly demonstrates that a substantial difference exists in spectrum utilization performance between Narrow-MUSE and the four all-digital systems. The differences among the four digital systems generally are far less pronounced, however. Based on this analysis, it would appear that Narrow-MUSE will not prove to be a suitable terrestrial broadcasting ATV system for the United States.
2. The Special Panel notes that many system proponents have proposed improvements to their systems in the area of spectrum utilization. The Special Panel finds that the system improvements, primarily those identified by its Technical Subgroup as ready for implementation in time for testing, may lead to improvements in spectrum utilization and should be subjected to testing as soon as possible.
3. The Special Panel finds that the degree of interference from ATV into NTSC, as reflected in the test results and the PS/WP3 report, is recognized as an area of concern in certain markets. The Special Panel finds that the issue of ATV into NTSC interference, including interference to BTSC audio, should be addressed in the remaining stages of the system selection process, including the examination of refined allotment/assignment techniques, the study of possible beneficial effects of system

4.4 PS/WP4 - WORKING PARTY ON ALTERNATIVE MEDIA TECHNOLOGY AND BROADCAST INTERFACE

The objective of PS/WP4 was to study and make recommendations regarding the relationship of terrestrial advanced television systems to alternative media, applications and standards. It was also the objective to investigate approaches for growth paths to the future while, at the same time, to support timely decisions on an ATV broadcast system with increased performance quality for the end user. PS/WP4 addressed issues related to interoperability, scalability, extensibility, and more generally, openness. Representatives of the broadcast television, cable television, program production, motion picture, computer, telecommunications, and imaging industries were active in this working party.

During 1991, PS/WP4 developed definitions of key terms such as interoperability, scalability and extensibility. Based upon a world becoming more complex and richer in alternatives (media, transmission/distribution, presentations), the working party developed the concept of image data, defined as the digital equivalent of the video information including image, sound and auxiliary data components.

Once SS/WP4 established the ten selection criteria, PS/WP4 adjusted its focus to concentrate on the three criteria that related to alternative media: Interoperability, Scope of Services and Features, and Extensibility.

An assessment of the five proponent systems in reference to the above three criteria was made by PS/WP4. The working party developed a layered architectural model¹ for ATV to aid in evaluating the proponent systems along with applications and performance questions on these criteria. Participants of PS/WP4 employed a technical consultant, StellaCom, Inc., to assist in this analysis. The assessments were based upon information supplied by each of the proponents in (1) published form, (2) response to specific PS/WP4 questions, and (3) a three-day Interoperability Review involving the proponents and a special Interoperability Review Board (convened specifically for evaluation of the proponent systems relative to the three criteria and conducted in September 1992). The Review Board consisted of experts across a broad array of relevant disciplines. The selected experts had no relationship to any of the system proponents. Results of the Review Board evaluation weighed heavily in the PS/WP4 conclusions and recommendations.

PS/WP4 identified a number of characteristics that contribute significantly to Interoperability, Scope of Services and Features, and Extensibility. These were based on needs and desires exhibited by alternative media advocates, not only for the delivery of terrestrial broadcast television programming, but also for other delivery approaches and applications relating to

¹ Similar to the Open Systems Interconnect (OSI) model for data communications developed by the International Organization for Standardization (ISO).

computing, communications, motion pictures, and imaging. In relative order of importance, these characteristics are:

An all-digital implementation based on a layered architecture model;

The use of universal headers and descriptors (as agreed by an industry standards group, for example, SMPTE);

Transmission of the signal in progressive scan format;

Use of a flexible, packet data transport structure;

Viewer transparent channel re-allocation (limited picture and sound while most of the channel capacity is devoted to data transmission for conditional access addressing or other purposes);

Ability to implement lower-performance, low-cost ATV receivers (comparable price/performance options to current NTSC receivers);

Ability to implement a low-cost ATV consumer VCR;

System architecture and implementation that will allow improvements and extensions to be incorporated as technology advances while maintaining backward compatibility;

Square pixels, or at least the option to select square pixel presentation;

Compatibility with relevant international standards, or commitment to this objective; and

Easily-implementable and user-accessible "still/motion multi-window transmission."

Specific recommendations regarding these characteristics are included in the PS/WP4 final report.

The PS/WP4 Working Group on Satellite Testing was formed to study the compatibility of the terrestrial ATV systems with satellite transmission for broadcasting and direct-to-home applications.

The working group based its evaluation on paper studies using proponent information supplied in response to a questionnaire and "Reference Link Models" which the working group developed.